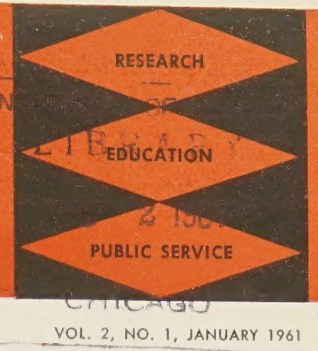


ENGINEERING OUTLOOK

AT THE UNIVERSITY OF ILLINOIS



UNIVERSITY OF ILLINOIS BULLETIN • COLLEGE OF ENGINEERING • ENGINEERING EXPERIMENT STATION

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HIGHWAY AND TRAFFIC ENGINEERING CONFERENCES

America is a nation of roads and road builders. More than 40,000 miles of new superhighways are scheduled for completion in the next few years. In the state of Illinois alone there are nearly 3,000 agencies which are concerned with highway and traffic engineering, construction, and law enforcement. The University of Illinois has long served as a research center and coordinating agency for these groups; in fact, the U. of I. Civil Engineering Department has been sponsoring highway engineering conferences since 1914!

The 47th annual Illinois Highway Engineering Conference is being held on the University campus February 28 through March 2. Some of the major topics to be discussed are *Economic Forecasts*, *Quality Control of Concrete*, *Medians for Divided Highways*, and *Relationships Between Urban Planning and Highway Planning*. Professor Ellis Danner, 300 Civil Engineering Hall, is the Highway Conference Director.

The 13th annual Illinois Traffic Engineering Conference is being held on March 2 and 3. The major topics in this conference will be *Community Planning and Traffic*, *Traffic Engineering Management Problems*, *Traffic Engineering in Medium and Small Communities*, and *Traffic Topics of General Interest*. Professor John Baerwald, 404 Civil Engineering Hall, is the Traffic Conference Director.

Advance registrations are available for either of these conferences through Professor Danner or Professor Baerwald. A registration fee of \$2.00 per person is charged, which entitles attendance at either or both conferences. This fee, which should not be mailed with advance registrations, is payable at the conference sign-in desks. All interested persons are invited to correspond with the conference directors for further information, advance registration forms, or conference programs.

SUMMER PROGRAM FOR TECHNICAL INSTITUTE TEACHERS

Technical institute and junior college teachers in mathematics, electronics, and machine design will have an eight-week summer institute available to them at the

University of Illinois next June 19 through August 12. The program is sponsored by the National Science Foundation, and financial assistance for all participants will be available in the form of stipends, dependent allowances, and travel allowances.

This summer institute is the direct outgrowth of the work of the Technical Institute Curriculum Advisory Committee, a University group which has been working with the Illinois State Office of Public Instruction to promote the establishment of a number of technical institutes throughout the state. This committee, made up of members of the University's College of Education and College of Engineering, has advocated this program to provide training in depth of subject matter for people who are now teaching in such existing institutes and may be instrumental in the establishment of new ones.

Members of the committee feel that one of the best solutions for the current shortage of engineers is the training of ample numbers of engineering technicians. The technician, requiring much less formal training than the engineer, can allow the engineer more time to make use of his abilities at the highest professional level. The committee members estimate that for the most efficient use of engineering manpower there would be three technicians for every engineer; the present ratio across the country is only one technician for each engineer.

In addition to the *Engineering Mathematics Course*, *Drafting and Mechanical Design Technology Course*, and *Electronics Engineering Problem Course*, there will be a series of seminars on the philosophy of technical institute education and the place of the technician on the engineering manpower team. Although there will be no tuition fees, there will be supplementary fees totaling \$9.00 and room and board expenses. The University will reserve housing for single persons or families upon request. Further information, housing forms, and applications are available from:

Professor J. S. Dobrovolsky
115 Transportation Building
University of Illinois
Urbana, Illinois

The deadline for applications is February 15, 1961.

KEEPING OUTWARD WITH THE TIMES

Current news articles suggest that the direction of the day for aeronautical engineers is faster and higher. Speeds reaching and even exceeding earth's escape velocity are common topics of conversation these days, and altitudes which might better be referred to as "outward" rather than upward appear in the news with regularity.

These are certainly more than just topics of conversation in the University's Aeronautical Engineering Department. This is well shown by recently completed modifications to the Department's shock tube. This device is now able to propel a shock wave through gas at velocities as high as 20 times the speed of sound, which makes it an extremely useful tool in this age of supersonic flight, missiles, and space exploration.

The shock tube was built in 1950. It was a single-diaphragm tube designed to produce shock waves of velocities approaching two and a half times the speed of sound. Such wave travel was produced by raising the pressure of an inert gas in one section of the tube to a pressure sufficient to suddenly break the diaphragm. The high pressure gases would then rush into the other end, compressing the gas in the low pressure section and thus producing a shock wave.

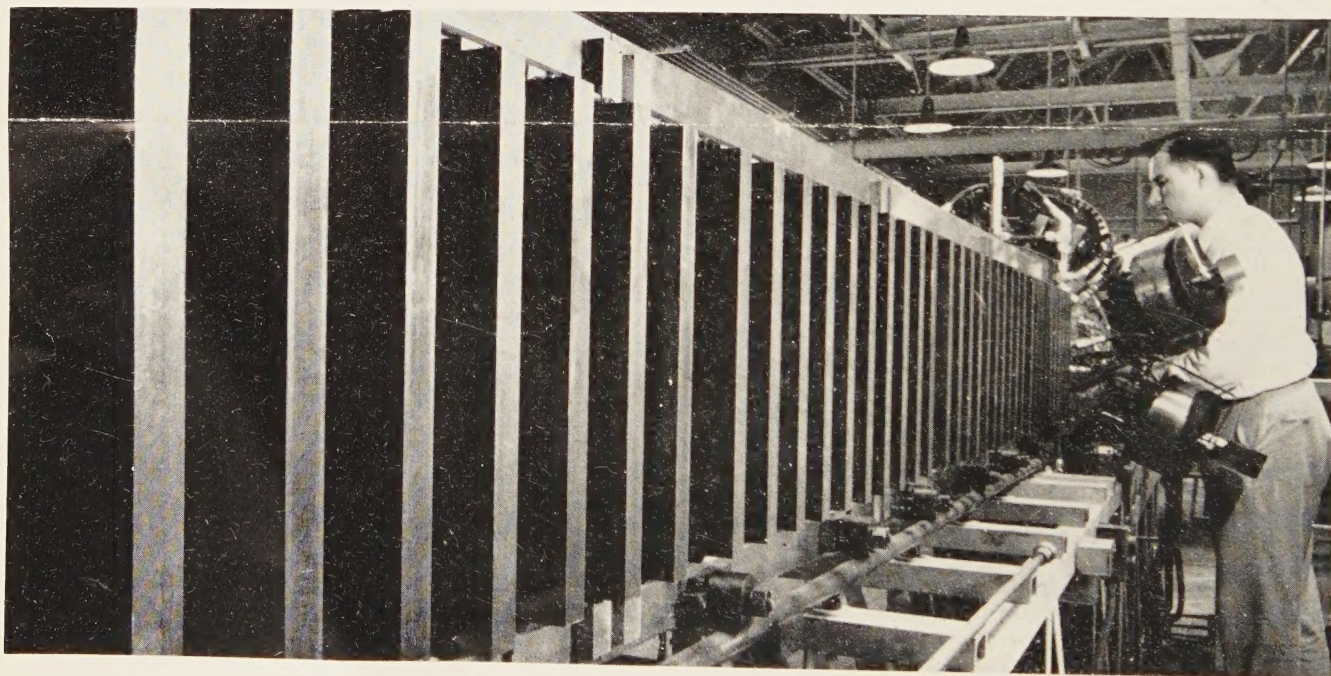
The modified tube is a double-diaphragm design with a combustion driver section, which makes it possible to heat the driver gas and thereby get increased velocities without proportionately increased pressures. So the 52-foot tube now has three sections: a combustion driver,

a buffer, and a driven or test section. When the gas in the combustion section is brought up to the desired temperature and pressure, it breaks the first diaphragm and drives the gas in the buffer section into the second diaphragm with great force. This diaphragm then ruptures, releasing the gases into the test section at high velocity. At Mach 20, the wave travels the 30-foot length of the test section in less than .002 second, and raises temperatures up to 11,000° F for times up to about .0001 second.

The shock tube is used for many different kinds of research projects in aeronautical engineering and in undergraduate laboratory experiments in aerodynamics. Some of the current studies include nose-cone atmosphere-re-entry temperature studies, microwave research for Gaseous Electronics, and chemical reaction studies in cooperation with the Department of Chemistry and Chemical Engineering.

The last project is a good example of the usefulness of this high-speed, high-temperature device. Chemical reaction processes do not increase in direct proportion to a temperature increase, so it is usually impossible for a researcher to calculate the chemical reaction which will occur at temperatures which are higher than the melting point of known container materials. He needs to measure directly, but, under ordinary circumstances, can not do so. With the help of the shock tube, he can. It will withstand thousands of degrees because the temperature rises and drops so quickly there is no damage to the inner walls of the tube. And this short transit time interval (2×10^{-3} sec.) is no disadvantage, because it is

The double-diaphragm shock tube is designed to produce Mach 20 shock waves. Professor Harold Barthel is shown putting a new diaphragm into the tube in preparation for an experiment.



still much longer than the shock heating time for any gas, which is approximately 10^{-9} second.

The shock tube is now a valuable asset to the Aeronautical Engineering Department's work at the high-speed, high-altitude end of the spectrum. There is, of course, still much work being done on piloted airplanes, but this now ranges from vertical take-off and landing vehicles to space planes. At the low-speed, low-altitude end of the Department's range of interests are the ground effect machines, wheelless vehicles that move close to the ground or water surface on "cushions of air."

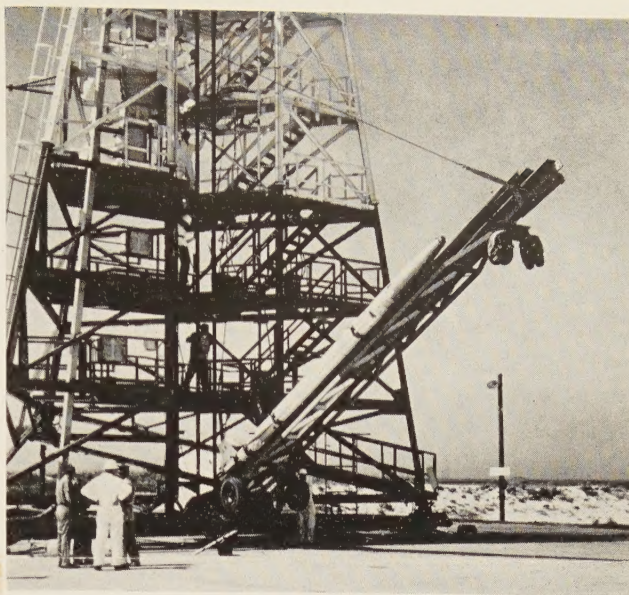
The vehicle performance spectrum illustrated by these examples indicates the breadth of interests of the Aeronautical Engineering Department today, and also shows that "higher and faster" is not the only direction aircraft technology is moving. "Lower and slower" vehicles, also of great importance today, can be studied in the laboratory without too much difficulty; however, vehicles at the high-speed end of the spectrum could not be studied on the ground at all without the use of such machines as the shock tube.

U. OF I. TEAM TO PROBE IONOSPHERE

Next spring a specially fitted Aerobee rocket will be fired from Eglin Field, Florida, which will culminate months of cooperative research by U. of I. engineering faculty. Engineers from the Electrical Engineering Department's Gaseous Electronics and Antenna Laboratories have worked together to provide the rocket's instrumentation, antenna system, and information gathering components. The basic experiment will be an attempt to extend to the actual ionosphere the laboratory "cross-modulation" technique developed in the Gaseous Electronics Laboratory under the direction of Professor L. Goldstein.

Because the ionosphere reflects radio waves at the frequencies used for short wave and commercial radio broadcasting, the development of techniques to control ionospheric disturbances that frequently interfere with such communications has long interested scientists. In this experiment, the rocket will be fired through the lower regions of the ionosphere, which are 45 to 65 miles above the earth. For the cross-modulation experiment, the rocket will carry a transmitter that will send out a high-powered radio signal at the "gyro-frequency" (about 1400 kilocycles), followed by a low-powered "sensing" signal. The temperature of the electrons in the ionosphere near the rocket will be raised by the first signal, which will change the properties of that portion of the ionosphere. The changes will be detected and measured by the sensing signal which follows.

If the experiment is successful, it will be an important step toward someday using ground radio signals or signals from satellites to control disturbances in the



An Aerobee solid fuel rocket of the sort that will be used in the U. of I. ionosphere experiment next spring is shown being lifted into firing position.

ionosphere that now sometimes impair radio communications.

This project is sponsored by the Geophysics Research Section of the Air Force Research and Development Command's Cambridge Research Center. The U. of I. research group is headed by Professors L. Goldstein, M. H. Crothers, and G. A. Deschamps.

Professor Crothers, who is in charge of instrumentation for the rocket, reports that tests of the rocket's circuitry are presently under way. Packaging of these electrical components into the Aerobee nose cone will follow the circuit experiments.

Professor Deschamps heads the group conducting research on antennas for the Aerobee. He reports that present experiments indicate that the rocket will carry two long primary antennas. These antennas will be used to transmit the radio signals for the cross-modulation experiment. Made of flat spring steel, they will be designed to slide out of the rocket to their full lengths while in the ionosphere.

The firing of the rocket will give the U. of I. engineers the opportunity to correlate the results of a test in the actual ionosphere with those already obtained in simulated ionosphere conditions in the laboratory. It also shows that rocketry, which is often thought of as having only military applications, can offer aid to researchers concerned with basic understanding of the physical world.

U. OF I. ENGINEER HONORED

A bronze plaque honoring the late Thomas C. Shedd, Professor of Structural Engineering at the University of

Illinois, was presented to the University by the Illinois Society of Professional Engineers at a luncheon in the Illini Union Building, at 12:30 p.m. on Saturday, January 7, 1961. The Board of Directors of the Illinois Society of Professional Engineers held its January meeting that day in the Illini Union Building.

Professor Shedd, on the U. of I. Civil Engineering Faculty from 1922 until his retirement in 1958, died July 11, 1959. He was a member of the Illinois Structural Engineers' Examining Committee from 1944 to 1959 and served as chairman for several terms. He was a member of the Illinois Professional Engineers' Examining Committee from 1945 to 1959 and served as chairman from 1945 to 1948. He was president of the Illinois Engineering Council for two terms. He also served as president and director of the National Council of State Boards of Engineering Examiners. In 1959 the Illinois Society presented him with the Illinois Award in recognition of these services.

NEW DOCTORATE FOR NUCLEAR ENGINEERS

Nuclear engineering at the University of Illinois "came of age" at the Board of Trustees meeting December 21. The Trustees approved the establishment of an advanced educational program leading to the Doctor of Philosophy degree in nuclear engineering.

The establishment of the new program came two years after the University's initiation of nuclear engineering training at the master's degree level. During that period 13 degrees have been awarded and physical facilities have come to include the Illinois TRIGA nuclear reactor, three subcritical nuclear assemblies, a heat transfer loop, a radio chemistry laboratory, and a nuclear metallurgy laboratory. The reactor began operation last July.

In announcing the initiation of the new degree, Nuclear Committee chairman R. J. Martin said, "The program

is based on the assumption that nuclear engineering is a new field, building on the existing engineering disciplines and the physical sciences, and dealing with the applications of nuclear reactions and radiations to engineering. Nuclear engineering uses knowledge from many areas of engineering and science. For this reason, the new doctoral program, like the existing master's program, will be directed by a committee with members of the graduate faculty from all departments of the College of Engineering."

The new doctoral program is expected to provide stimulus to the College of Engineering's research in nuclear engineering. "In order to utilize fully our capabilities for productive research, we must have graduate students identified with the program during the time period required for the doctorate. Only with this much time can a continuity of training and research experience be achieved," Professor Martin said.

The new program will provide men with advanced training in a field that is growing rapidly in importance in virtually all fields of industry, research, and the nation's defense effort. Nuclear power and propulsion plants are coming into use for both civilian and military applications. Uses for nuclear technology are being found in industry and agriculture both as research tools and as aids to testing and production. As these uses increase, the need for trained nuclear engineers for research, design, and operation threatens to remain far ahead of the limited supply. The establishment of the nuclear engineering educational program at the University of Illinois, planned and developed over a period of years, will help increase that supply.

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